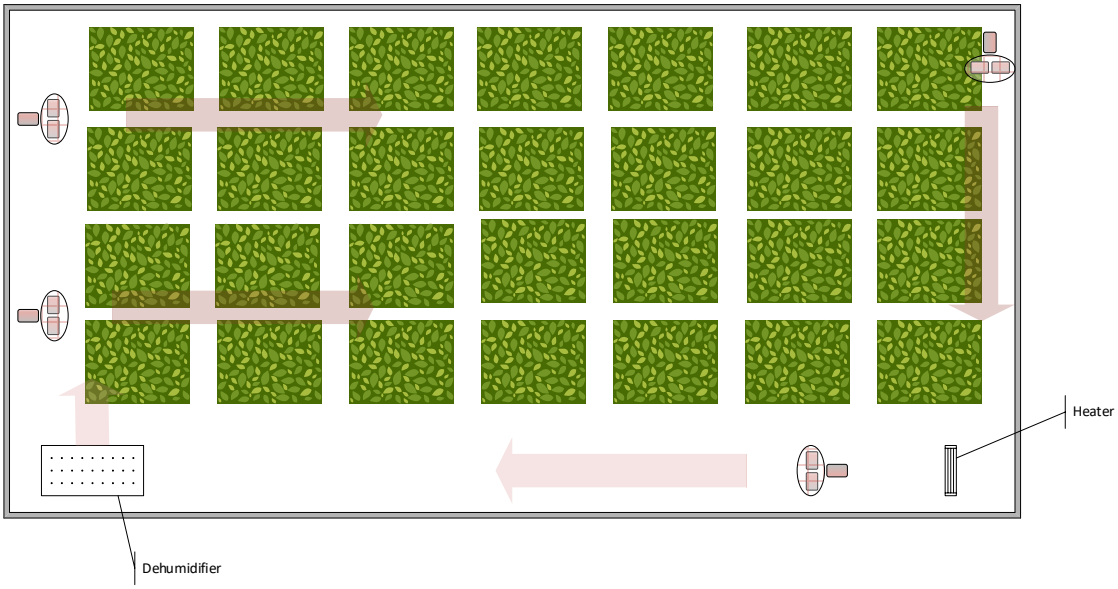
Placement of Air Circulators in a Grow Room or Greenhouse

Designing an air circulation system for a Grow Room or greenhouse is quite a difficult problem! There is no single answer or perhaps no best solution since it depends on a very large number of factors!

Planning is everything! No surprise there. Clearly the objective is to provide the optimum environment for your crop. But one needs to keep in mind that this is not just airflow. It is airflow plus humidity (and humidity control); it is temperature; it is carbon dioxide concentration; it is cyclical variation depending on the time and stage of growth of the plants. This means that it not only just the air circulation fans but the other devices that affect these variables such as heaters, dehumidifiers, exhaust fans, air filters, air supply, air conditioning systems, etc. All these various devices need to be accounted for in the plan so that they are not "fighting" one another.



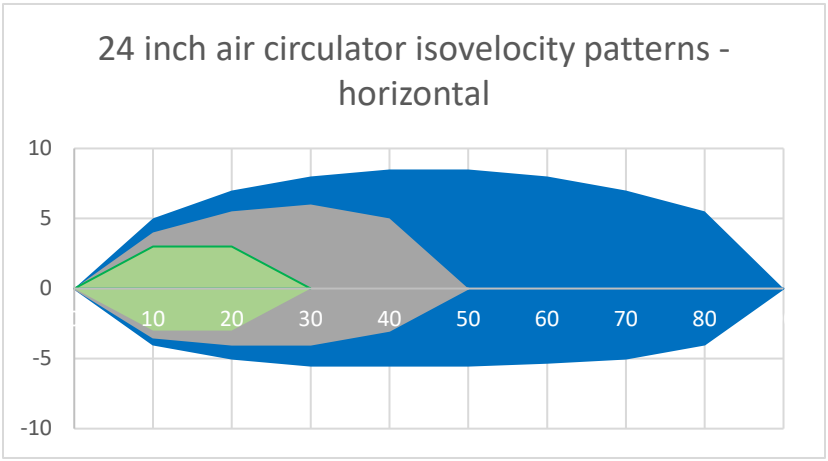
Above is an example grow room which is 60 x 30 feet and has a heater and a dehumidifier. Overall the flow of air is clockwise with two air circulators pushing air down the rows. At the other end of the rows, there is another air circulator which in turn pushes the air towards the heater. And finally, an air circulator just downstream from the heater. Why? Because typically the flow out of a heater is based on the requirements of the heater itself. It is not necessarily designed to push air a long distance. Additionally, hot air is lighter (and hot humid air is even lighter yet), so this air circulator both pushes the air along and also tends to mix the hotter air provide a more uniform mixture.

Keep in mind this is just a typical set up – it is not specifically a recommendation. What it does provide is some guidance towards having the various equipment work in an overall pattern rather than fighting against one another.

Just a note – contrary to some of the information that is available, you cannot "pull" air from any distance to the inlet of a fan. The air will all come from the immediate area of the inlet including off to the sides of the inlet. This is quite different from the outlet. At the outlet you have a high velocity of air that has momentum and it will be projected for quite some distance from the fan.

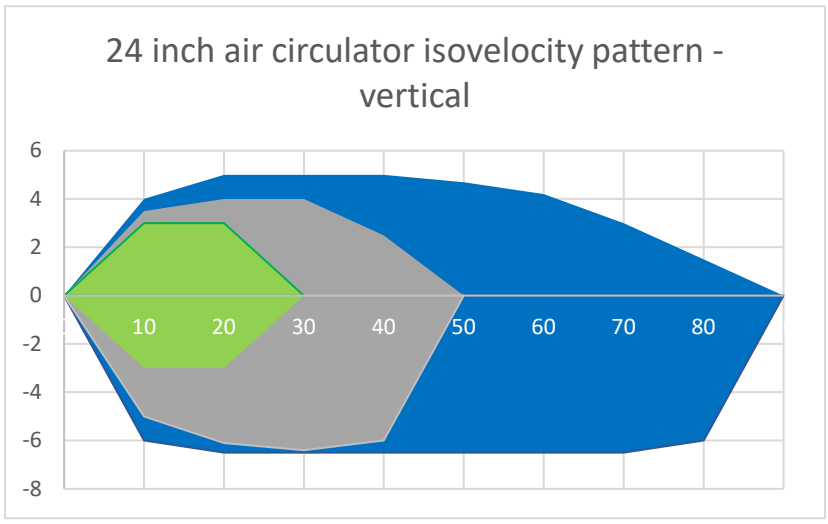
Some hints on placement based on air circulator performance:

The output of an air circulator is a rotating cone of air that eventually dissipates at some distance (around 30 to 40 diameters of the fan). Here is what the output of a 24 inch unit roughly looks like:



Note: The discharge is not symmetrical – it is biased toward the left (top of graph). This is due to the rotation of the air as it exits the propeller.

The blue area being down to 100 feet per minute (at the edge). The grey being 200 fpm, and the green 300 fpm. Note – small areas of higher velocity are not shown.



The "cone" of air descends the further from the unit. The testing for this was done with a pedestal unit which was 6-1/2 feet from the floor, so the descent was cut off at this level, otherwise it would continue to descend.

Note: Values are in feet for both graphs.

Keep in mind – the information above is based on measurements in an empty room therefore with no interaction between the airflow and the room contents. A grow environment will certainly change the airflow pattern somewhat as it interacts with the foliage.

So what does this information tell you? First, since the airflow is going to sink – you will want to put your air circulators as high in the room as is feasible. Keep in mind that you may want to be able to reach them so as to adjust the angle of discharge as the canopy grows.

A little more detail – let's say that you want to have at least 100 feet per minute (fpm) across your plants but no more than 299 fpm (the blue and grey area in the graph above). You can see that the higher velocity of 300 fpm and above sinks about 3 or 4 feet from the discharge. If you have the fan located so that this area remains above your canopy, then you will eliminate this high velocity on the plants nearest the fan. Alternately you can angle the discharge of the unit upwards to achieve the same.

FYI – if one subtracts the area above 300 fpm, then based on the horizontal coverage, one gets about 2600 square feet of area at the above 100 fpm but below 299.

One final thought; in addition to air circulators for the canopy, one might also want to consider below canopy air. Two reasons for this. One, if you use supplemental carbon dioxide it is generally denser than the room air (depending upon temperature). As such it will tend to sink to the floor. Placing small portable fans on the floor angling up will reinject and mix this back into the room. Second, many grow operations want to reduce moisture just above the root line for "dry out". Placing small variable speed fans at this level will aid in this endeavor. The fans need not be pointed in the same direction as the air above the canopy. In the example above, one might have four or five small fans that are at the top of the bed column that push the humid air down towards the aisle and the dehumidifier.

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